IOTA

INFRASTRUCTURE
OPERATIONS
TOOLS
ACCESS

Infrastructure Operations Tools Access

IOTA

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Outline

- Why IOTA
- What is IOTA
- Source Interfaces and Applications
- Supporting the Warfighter
- Current Status
- FY05 Plans
- Points of Contact

Why IOTA

Why IOTA

- Information integration is required to achieve warfighting objectives.
- Analysts and warfighters need to focus on understanding the information, not the processes to collect and disseminate it.

Therefore

- Access to information should be part of the infrastructure and provided by machine to machine conversations.
- Information visualization must facilitate analysis and understanding and be supported by rapid integration of new information.

DoD CIO's Net-Centric Data Strategy (23 May 2003)

- Ensure data are visible, available, and usable when and where needed
- Metadata tagging for discovery
- Share information
- Interoperability within communities of interest

Why Web Services

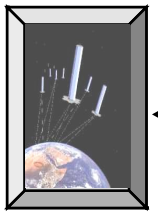
- “Web services, in brief, are a framework of software technologies designed to support interoperable machine-to-machine interaction over a network.” (Neal Leavitt, “Are Web Services Finally Ready to Deliver”, IEEE Computer, Nov. 2004)
- “Web services is about accessing and connecting data and unlocking the value of that data, especially in legacy systems” (Ron Favoli, spokesperson for IBM, quoted in article above)
- Web services “also allow IT organizations to build a new class of software applications that vastly improve their ability to integrate the hodgepodge of software applications and architecture that are found in most enterprises today” (Joe Keller, VP Marketing for Java Web services at Sun Microsystems, quoted in article above)

What is IOTA

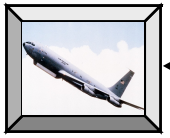
IOTA Approach

- Provide **enterprise-wide**, secure information discovery, dissemination, and management from distributed data sources.
- Develop the **mechanisms** to quickly put accurate, integrated and complete information in the hands of the Warfighter.
- Provide **robust architecture** to rapidly accommodate future Web-based data discovery and dissemination requirements.

Infrastructure is the Key



Space-Based Sensors



Joint Stars

SIGINT sensors

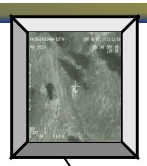
High Side

Data Repositories

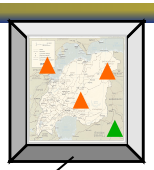
Production and Exploitation Site

Production and Exploitation Site

Production and Exploitation Site



Archived Imagery/Video



Archived GMI

IOTA

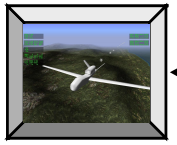
JTT Target Folders

Analytical Tools – A2IPB, WebTAS

Information Management Tools

STAR Cross-Domain Services

Low Side



Global Hawk

Predator

Production and Exploitation Site

Production and Exploitation Site

IOTA

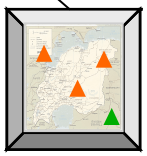
JTT Target Folders

Analytical Tools – A2IPB, WebTAS

Information Management Tools

Commercial Imagery

Archived Imagery/ Video



Archived GMI

IOTA Objectives

Provide AF GDIP community implementation of Global Information Grid Enterprise Services (GIG ES) for

- Security
- Discovery
- Application
- Mediation
- Storage
- Enterprise Services Management
- Messaging
- Collaboration
- User Assistance

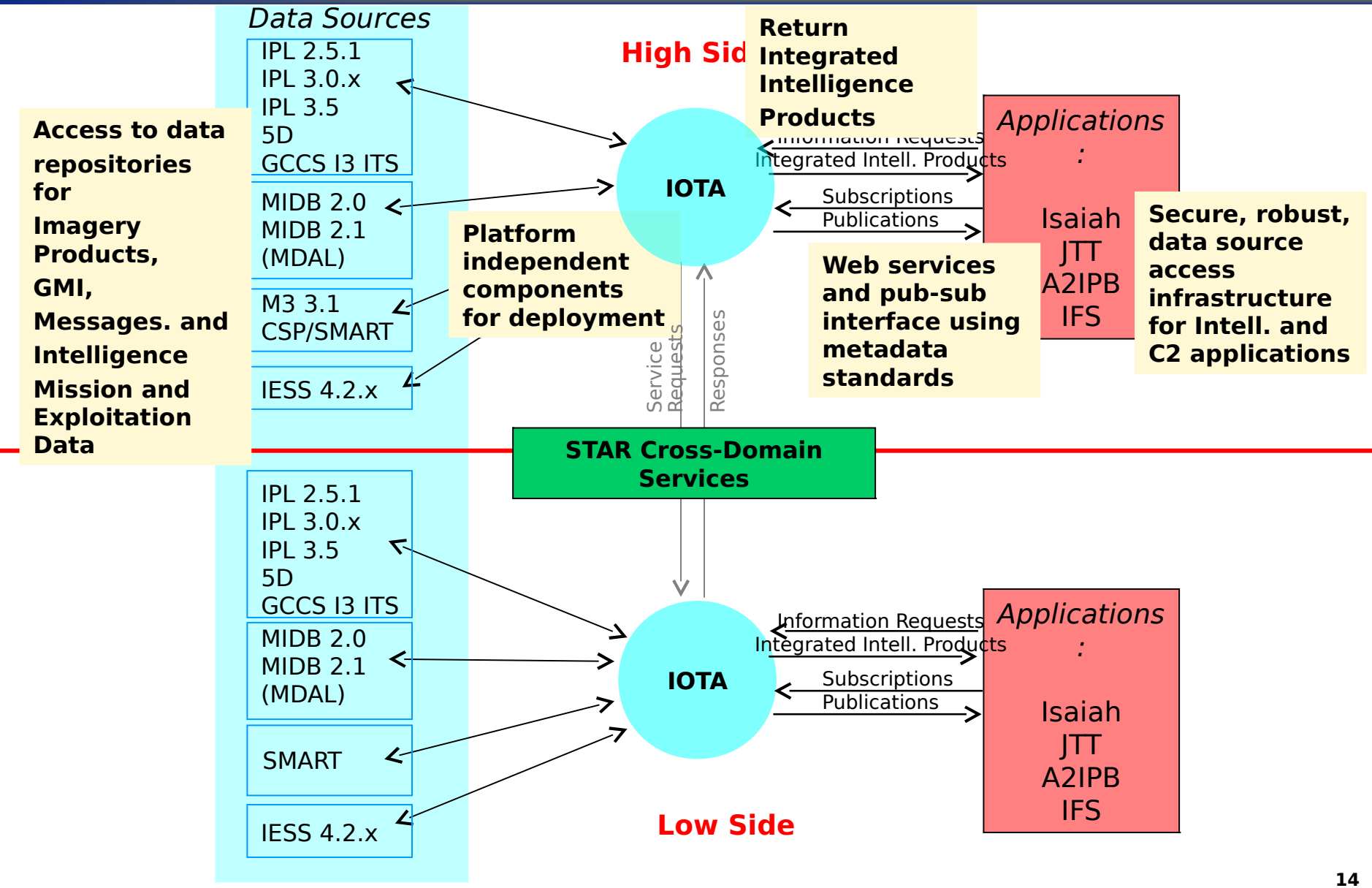
GIG Core Enterprise Services

FY04 Achievements

- Provide the infrastructure for
  - Automated generation of time critical intelligence products
  - Web-based Intelligence product dissemination
- Provide robust component-based architecture to rapidly accommodate future Web-based data discovery and dissemination requirements
  - Reduce personnel required for Web site maintenance

Source Interfaces and Application

IOTA Current Capabilities



IOTA Capabilities

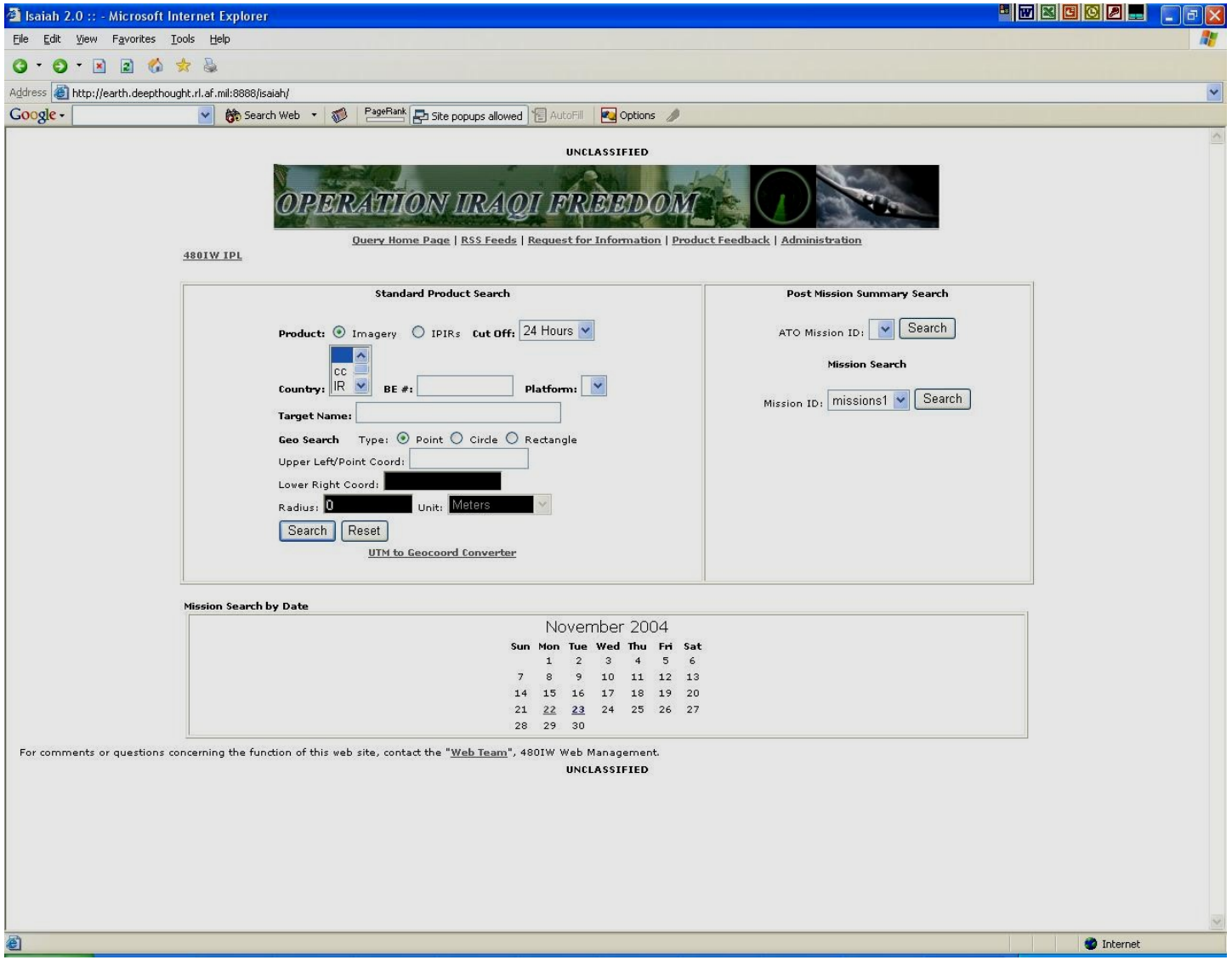
- Secure information request services to make data available to Intelligence and C2 COIs.
  - **current data sources: IPL, MIDB, IESS, M3, CSP/SMART**
  - **planned data sources: DMS, Weather, NTISR**
- Secure Publish-subscribe for automatic information updates to applications
  - **based on JBI in-house pub-sub-query software v. 1.1**
- Cross-security domain pub-sub with ISSE Guard
  - **planned certification for IOTA 2.0 in Q3 2005**

IOTA Applicability

- IOTA provides services for data source access that ANY application can use. This is useful in situations
  - Where more than one application requires the same data
  - Where a single point for discretionary access control is required
  - Where an application has to connect to different data sources in different environments where it is deployed to obtain the same data
- IOTA provides Integrated Products (Results Sets) – a single query hits multiple data sources
  - Data sources are configured at installation time (in IOTA 1.0)
  - Application uses well-defined service request parameters (e.g., BE number, geographic area, key words, date-time ranges)
- IOTA uses a standard representation for results and translates data source returns
- IOTA provides publish-subscribe for applications to automatically receive new data from data sources

Supporting the Warfighter

Isaiah 2.0


Isaiah 2.0 :: - Microsoft Internet Explorer
File Edit View Favorites Tools Help
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Standard Product Search
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Geo Search Type: Point Circle Rectangle
Upper Left/Point Coord:
Lower Right Coord:
Radius: 0 Unit: Meters
Search Reset
UTM to Geocoord Converter
Post Mission Summary Search
ATO Mission ID: Search
Mission Search
Mission ID: missions1 Search
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November 2004
Sun Mon Tue Wed Thu Fri Sat
1 2 3 4 5 6
7 8 9 10 11 12 13
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For comments or questions concerning the function of this web site, contact the "Web Team", 480IW Web Management.
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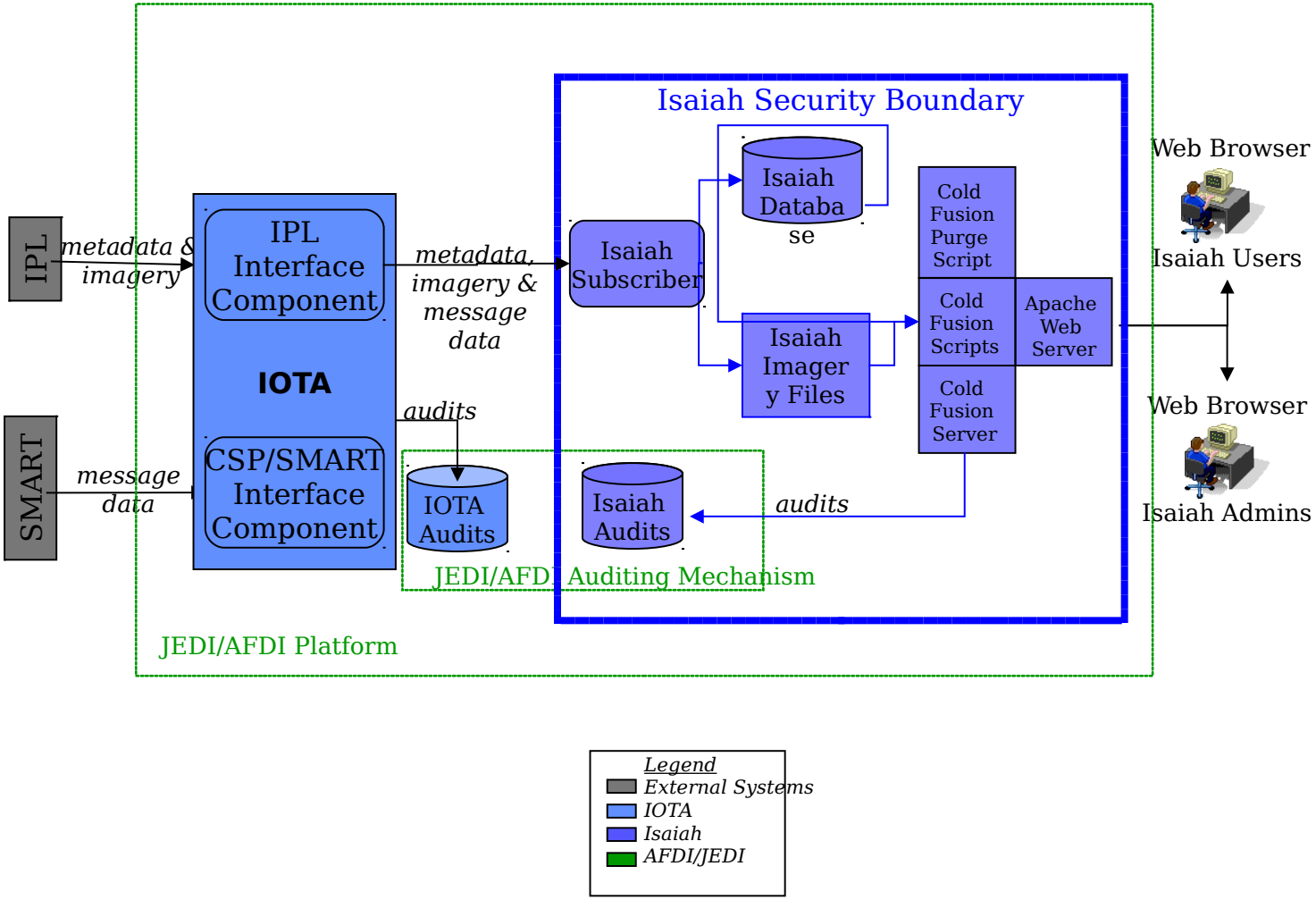
Isaiah 2.0 Architecture



Joint Targeting Toolbox (JTT)

- **Provide access to varying imagery data sources with a common set of services**
  - **IPL 2.5.1/3.0.x/3.5, GCCS I3 ITS**
- **Beta 1 Test in January 2005 at JITF**
- **JTT 3.x will incorporate publish-subscribe for target folder updates**
- **JTT 3.x requirements are being reviewed for additional data source requirements (e.g., MISREPS, WSV and BDA data)**

Automated Assistance for Intelligence Preparation of the Battlefield (A2IPB)

- Provide access to imagery and GMI data
- Uses services for initial data retrieval to start IPB process and pub-sub for updates
- Beta 2 Test in January at NASIC
- Potential for services to provide access to A2IPB products
  - A2IPB becomes both a data source and consumer application for IOTA
  - cross-boundary services would allow high-side business processes to deliver low-side information products

Current Status

IOTA Status Mar. 28, 2005

- **JEFX 04**
  - **JTT 3.0 Target Folder imagery access**
  - **Information Extraction Processing System, IEPS**
    - ***recommended for transition***
- **IOTA DoDIIS accreditation**
  - **Beta I and 2 tests completed. Beta 1 problems addressed. No Beta 2 findings.**
  - **IATO received for 480IW Beta 2 site.**
  - **Certificate to Field received 18 Jan. 2005**
- **Isaiah 2.0**
  - **Delivered to 480IW on Nov. 15, 2004**
  - **Security tests completed. Approval to add to high-side baseline**
  - **Site accreditation for SIPRNet at 480IW received 13 Dec. 2004**

FY05 Plans

FY05 Plans

- **IOTA 2.0 (Beta testing in Summer 2005)**
  - metadata production services for imagery (IPL cataloging services)
  - text message parsing with data extraction services (NG-GIP integration)
  - rapid service configuration and deployment for database and live feed sources
  - additional data sources
    - Weather
    - DMS (if available)
    - Non-traditional ISR
    - upgrades for IESS, MIDB, IPL
- **Continued development of Trusted ISSE Gateway for Exploration and Retrieval (TIGER) and IOTA cross-boundary pub-sub**
  - support for NTISR IS initiative in JEFX 06

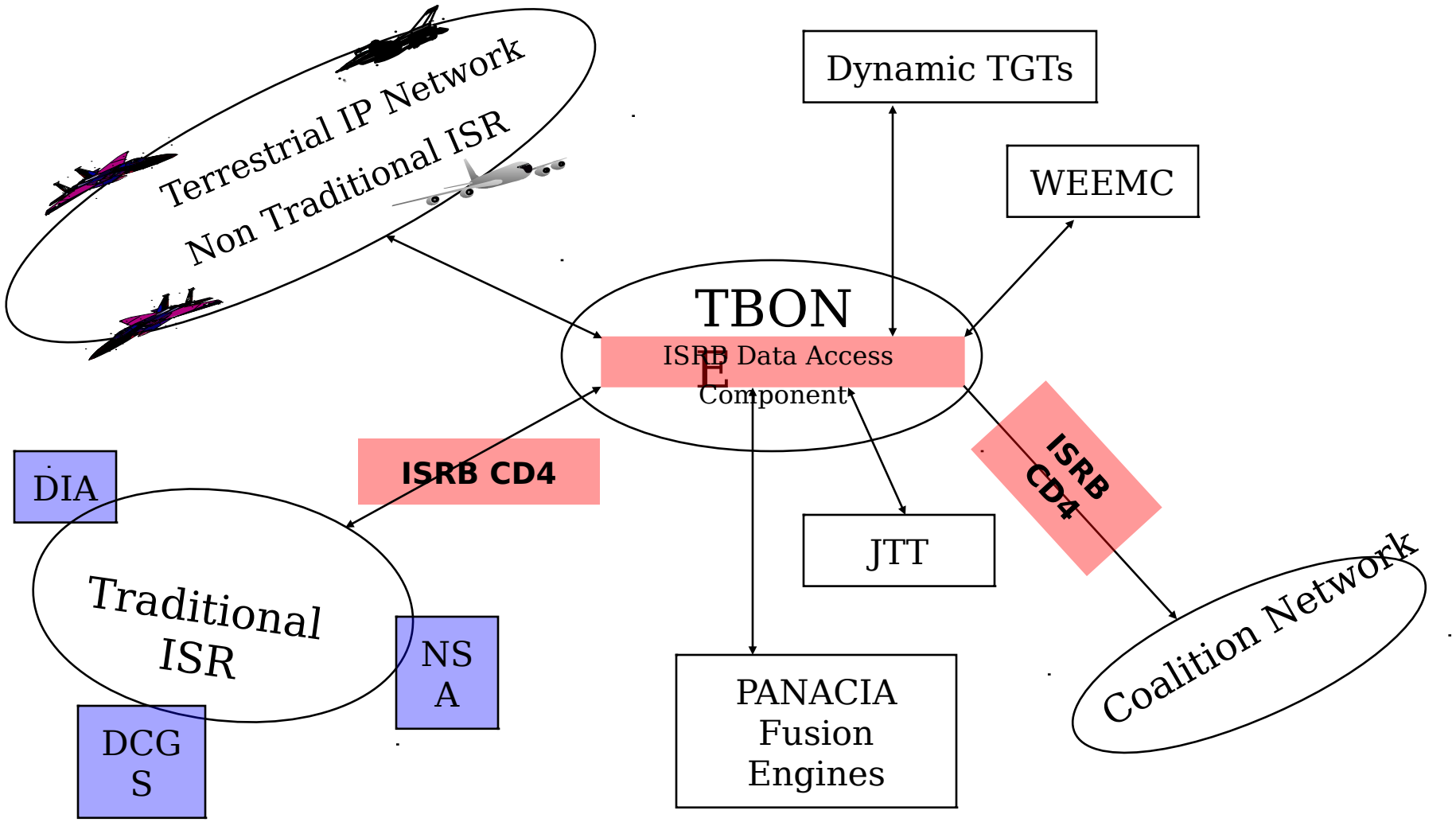
IOTA 2.0 Milestones

June 6 – July 1	**In-plant acceptance testing**
July 31	**DoDIIS Beta 1 completed**
August 31	**DoDIIS Beta 2 completed**
September 30	**DoDIIS Certificate/Approval to Field**
October 3	**JEFX 06 Spiral 1 Start**
	2006
January 9	**JEFX 06 Spiral 2 Start**
February 27	**JEFX 06 Spiral 3 Start**
April 17	**JEFX 06 Main Exercise start**

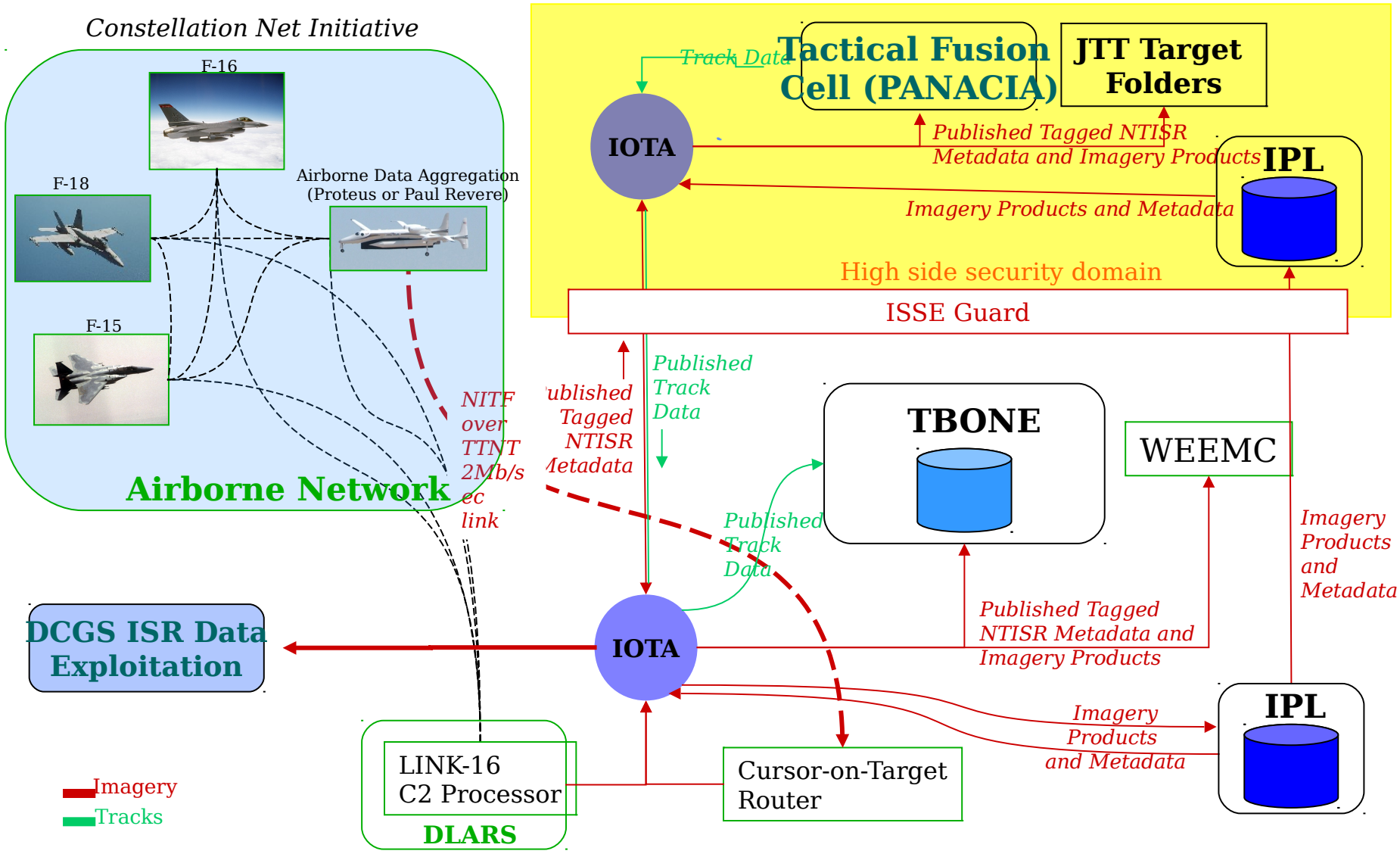
IOTA Initiative for JEFX 06

- **IOTA is aimed at supporting the ISR BattleLab JEFX 06 Initiatives on Non-Traditional ISR Data Dissemination (presented by LtC. Wyman at Dec. 17 Technical Interchange between AFRL/IF and AFC2ISRC/CCT)**
  - **ISRB Data Access Component (DAC): Assemble, Store and Disseminate Traditional and Nontraditional ISR Data.**
  - **ISRB CD4: Cross Domain Data Dissemination Device: Disseminates NTISR data and fusion products across security boundaries**

Concept for Data Flow Dissemination (LtC. Wyman)



JEFX 06 NTISR IS Data Access and Dissemination Architecture



Points of Contact

IOTA Points of Contact

- **AFRL PM, DSN 587-3793, 315-330-3793, loretor@rl.af.mil**
- **DoDIIS Executive Agent, DSN 575-1126, 757-225-1126, christopher.colbow@langley.af.mil**
  - **Todd Haller, DSN 575-3028, 757-225-3028, Todd.Haller@langley.af.mil**
- **Lead Engineer, DSN 587-3814, 315-330-3814, barths@rl.af.mil**

Isaiah and IOTA Web Sites

- **Web sites**
  - **Internet [unclass. open to public]**
    http://www.rl.af.mil/programs/iota/
  - **Extranet [unclass. open to customer base]**
    https://extranet.if.afrl.af.mil/iota/
  - **SIPRNet http://ife.rl.af.smil.mil/iota/**
  - **INTELINK http://web1.rome.ic.gov/iota/**
- **Isaiah (480th deployment)**
  - **SIPRNet: http://intelink.480iw.langley.af.smil.mil**
  - **INTELINK: http://intelink.accis.ic.gov**

IOTA

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IOTA and Isaiah Background

IOTA Types of Services – FY04

- Information Dissemination
  - *Product Requests*
    - integrated product metadata search ("find all reports and imagery about this range of BE numbers and return metadata - date, location, source, other collection missions, etc.")
    - integrated product request ("return all integrated products containing reports and imagery matching some criteria")
    - single type product metadata request (find all imagery metadata meeting some metadata criteria)
    - single type product request (return all imagery matching some criteria)
    - single source product metadata search (find all imagery metadata from IPL 3.0 meeting some metadata criteria)
    - single source product request (return all imagery from IPL 3.0 meeting some metadata criteria)
  - *Product Subscription*
    - subscribe to integrated product metadata
    - subscribe to integrated products
    - subscribe to single type product metadata
    - subscribe to single type product
    - subscribe to single source product metadata
    - subscribe to single source products

IOTA Types of Services – FY04

- Information Discovery
  - List sources available ("list the known data sources")
  - List product types available ("list the known available product types: e.g. result would be NITF images, MPEG2 videos, IPIRs, INTSUMs")
  - Subscribe to product types available ("tell me when a new type is added")
  - Subscribe to sources available ("periodically report all active data sources" or "when a new data source is added, push its description to me")

- Information Management
  - *Imagery Product Cataloging*
    - metadata verification
    - product catalog
    - product catalog verification

IOTA Services

Service Name	*Description*	*Input Parameter Types*
getImageryMetadata_byBE	Return imagery metadata associated with a specified BE number.	Optional data source list, BEnumber
getImageryMetadata_byBEdtkw	Return imagery metadata associated with a specified BE number, date-time range, and keyword list.	Optional data source list, BEnumber, DTrange, KeywordList
getImageryMetadata_byBEkw	Return imagery metadata associated with a specified BE number and keyword list.	Optional data source list, BEnumber, KeywordList
getImageryMetadata_byGl	Return imagery metadata associated with imagery in a rectangular or circular geographic area.	Optional data source list, GeoLocation
getImageryMetadata_byBEdt	Return imagery metadata associated with a specified BE number and date-time range.	Optional data source list, BEnumber, DTrange
getImageryMetadata_byGldt	Return imagery metadata associated with a specified date-time range and a rectangular or circular geographic area.	Optional data source list, GeoLocation, DTrange
getImageryMetadata_byDt	Return imagery metadata associated with a specified date-time range.	Optional data source list, DTrange
getImageryMetadata_byDtkw	Return imagery metadata associated with a specified date-time range and key word list	Optional data source list, DTrange, KeywordList
getImageryMetadata_byGldtkw	Return imagery metadata associated with a specified rectangular or circular geographic area, date-time range, and keyword list.	Optional data source list, GeoLocation, DTrange, KeywordList
getImageryMetadata_byGlkw	Return imagery metadata associated with a specified rectangular or circular geographic area and keyword list.	Optional data source list, GeoLocation, KeywordList

Table 1a. IOTA Version 1.0 Imagery Metadata Services

IOTA Services (cont.)

Service Name	*Description*	*Input Parameter Types*
requestImageryViaFtp_withConversion	Order imagery products to be delivered through FTP and converted to a specified image format	sAccessid, sConversion, IotaFtpDestination
requestImageryViaFtp	Order imagery products delivered through FTP with no conversion	sAccessid, IotaFtpDestination
requestImageryViaHttp_withConversion	Order a URL on the IOTA Web server for an imagery product converted to a specified image format.	sAccessid, sConversion,
requestImageryViaHttp	Order a URL on the IOTA Web server for an imagery product with no conversion	sAccessid

Table 1a. IOTA Version 1.0 Imagery Product Request Services

IOTA Services (cont.)

Service Name	*Description*	*Input Parameter Types*
getMessages_byBE	Return metadata and text of messages or reports associated with a specified BE Number.	Optional data source list, BEnumber
getMessages_byBEmt	Return metadata and text of messages or reports of a specified type and associated with a specified BE Number.	Optional data source list, BEnumber, MessageType
getMessages_byBEdt	Return metadata and text of messages or reports associated with a specified BE Number and date-time range.	Optional data source list, BEnumber, DTrange
getMessages_byBEdtmt	Return metadata and text of messages or reports of a specified type associated with a specified BE Number and date-time range.	Optional data source list, BEnumber, DTrange, MessageType
getMessages_byDt	Return metadata and text of messages or reports associated with a specified date-time range.	Optional data source list, DTrange
getMessages_byDtmt	Return metadata and text of messages of a specified type associated with a specified date-time range.	Optional data source list, DTrange, MessageType
getMessages_byDtkw	Return metadata and text of messages or reports associated with a specified date-time range and keyword list	Optional data source list, DTrange, KeywordList
getMessages_byDtkwmt	Return metadata and text of messages of a specified type associated with a specified date-time range and keyword list	Optional data source list, DTrange, KeywordList, MessageType
getMessages_byKw	Return metadata and text of messages associated with a specified keyword list	Optional data source list, KeywordList
getMessages_byKwmt	Return metadata and text of messages of a specified type associated with a specified keyword list	Optional data source list, KeywordList, MessageType

Table 1b. IOTA Version 1.0 Messages and Reports Family Services

IOTA Services (cont.)

Service Name	*Description*	*Input Parameter Types*
getGMIFacility	Returns a Facility Object for each facility matching the filter	Facility Filter
getGMIFacility_wEqp	Returns a Facility Object for each facility matching the filter with any equipment associated to that facility	Facility Filter
getGMIFacility_wUnits	Returns a Facility Object for each facility matching the filter with any Units associated to that facility	Facility Filter
getGMIFacility_wEqp_Units	Returns a Facility Object for each facility matching the filter with any equipment and Units associated to that facility	Facility Filter
getGMIFacility_byUnit	Returns a Facility Object for each facility related to a Unit ID	Unit ID
getGMIUnit	Returns a Unit Object for each Unit matching the filter	Unit Filter
getGMIUnit_wEqp	Returns a Unit Object for each Unit matching the filter with any associated equipment	Unit Filter
getGMIEqp	Returns an Equipment Object for each piece of equipment matching the filter	Eqp Filter
getGMIIndividual	Returns an Individual Object for each Individual matching the filter	Individual Filter
getGMILOC	Returns a LOC Object for each LOC matching the filter	LOC Filter

Table 1c. IOTA Version 1.0 GMI Services

IOTA Services (cont.)

Service Name	Description	Input Parameter Types
getConfiguredDatasources	Return list of data sources available through IOTA services	*none*
getConfiguredDatasourcesByFamily	Return list of data sources associated with a specified family of services (Imagery, Messages, or GMI)	family_name
getConfiguredDatasourcesByMethodName	Return list of data sources	method_name

Table 1d. IOTA Version 1.0 Discovery Services

Service Name	Description	Input Parameter Types
updateProperties	Re-load IOTA properties files and restart the IOTA services. (Any property changes will become effective).	*none*

Table 1e. IOTA Version 1.0 Administrative Services

IOTA – Weather Interface

- **Currently developing prototype interface to the Joint Weather Impact System, JWIS, in the Product Integration Center (PIC).**
- **IOTA will provide front end services that allow for integration of JWIS data with data from other sources.**
  - for example, a service to return information about a facility and the current forecast for weather in that geographic area.
  - or a service to obtain weather map products for a target area for mission planning.
- **First iteration IOTA weather services will provide basis for pub-sub for weather data.**

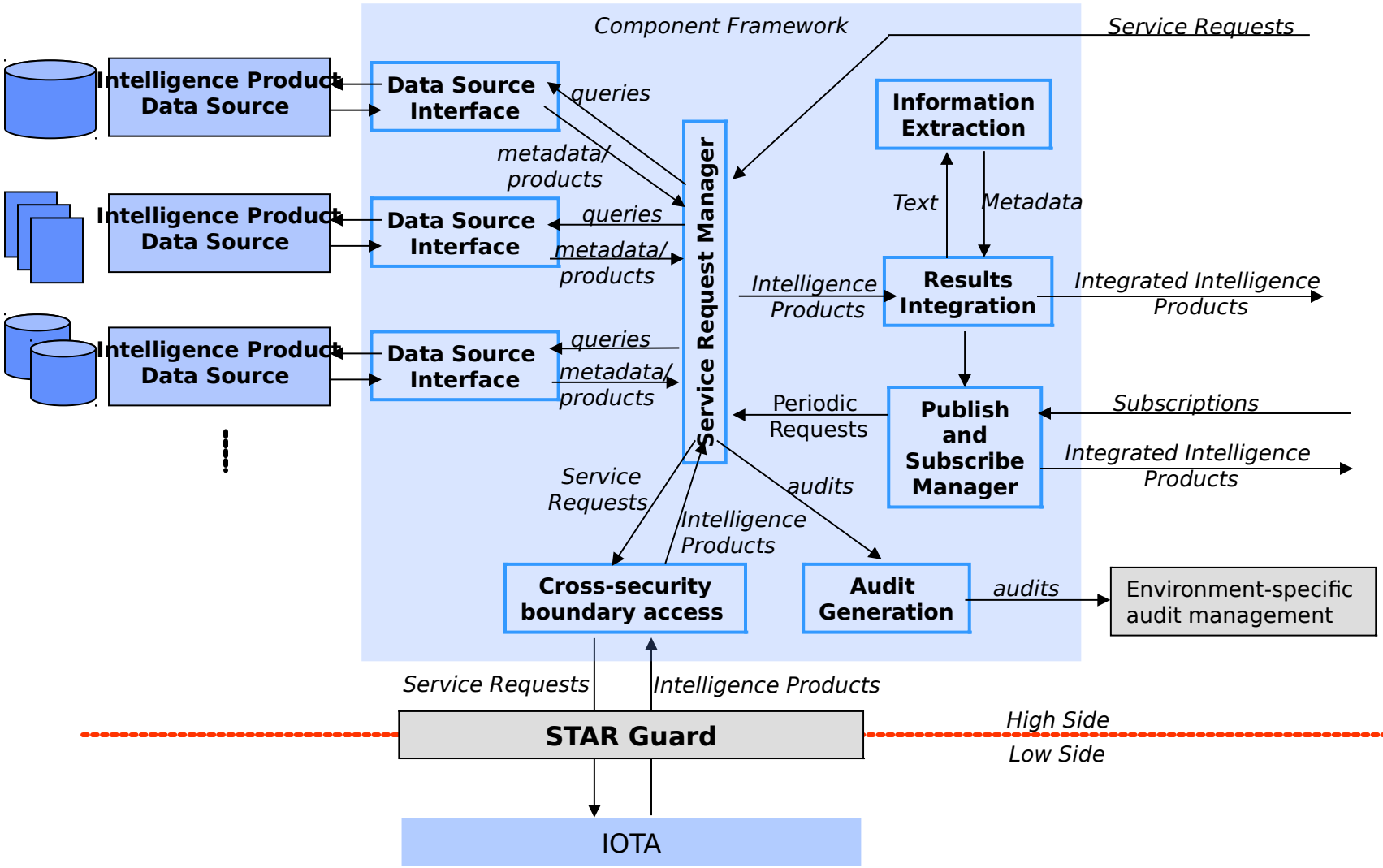
IOTA Engineering Challenges

- **Applications are the users**
  - Other applications will depend on IOTA services
  - IOTA is not focused on developing end-user applications
- **Services are components**
  - Service components can be added without affecting existing services or applications using them
  - Application servers (e.g., JBoss, WebLogic) define the platform (not the hardware and OS)
- **IOTA is infrastructure**
  - Services should be available everywhere anytime

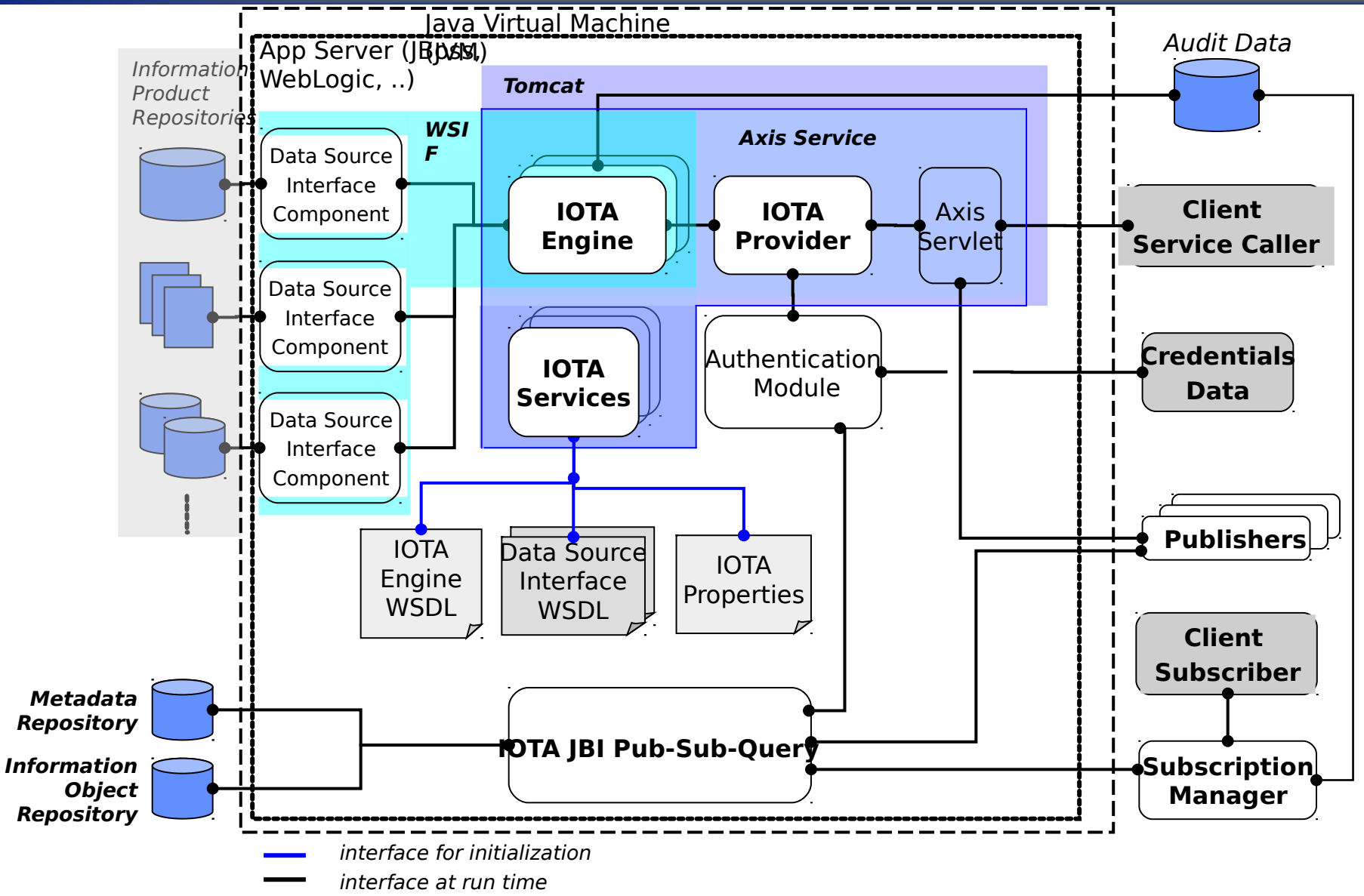
IOTA Technology Challenges

- **Automated Metadata Generation**
  - generating metadata for information products, e.g., data extraction
  - filling in missing or incomplete metadata, resolving discrepancies
- **Automated Metadata Handling**
  - combining metadata from different sources, information pedigree
- **Services across security domains**
  - service transactions across security boundaries
  - publish and subscribe

IOTA Architecture Details



IOTA Architecture Implementation



IOTA Publish-Subscribe

- Uses JBI in-house platform v. 1.1 components
- Added heartbeat for publisher and subscriber awareness
- Integrated with commercial Application Server, WebLogic, and Open Source app server (JBOSS). JBOSS-only features were purged.
- Integrated with Web services security features: authentication through Java Authentication and Authorization Service (JAAS), audits, SSL
- Defined Information Objects for product family subscriptions
- Automated product family publisher generation
- Made independent of database engine

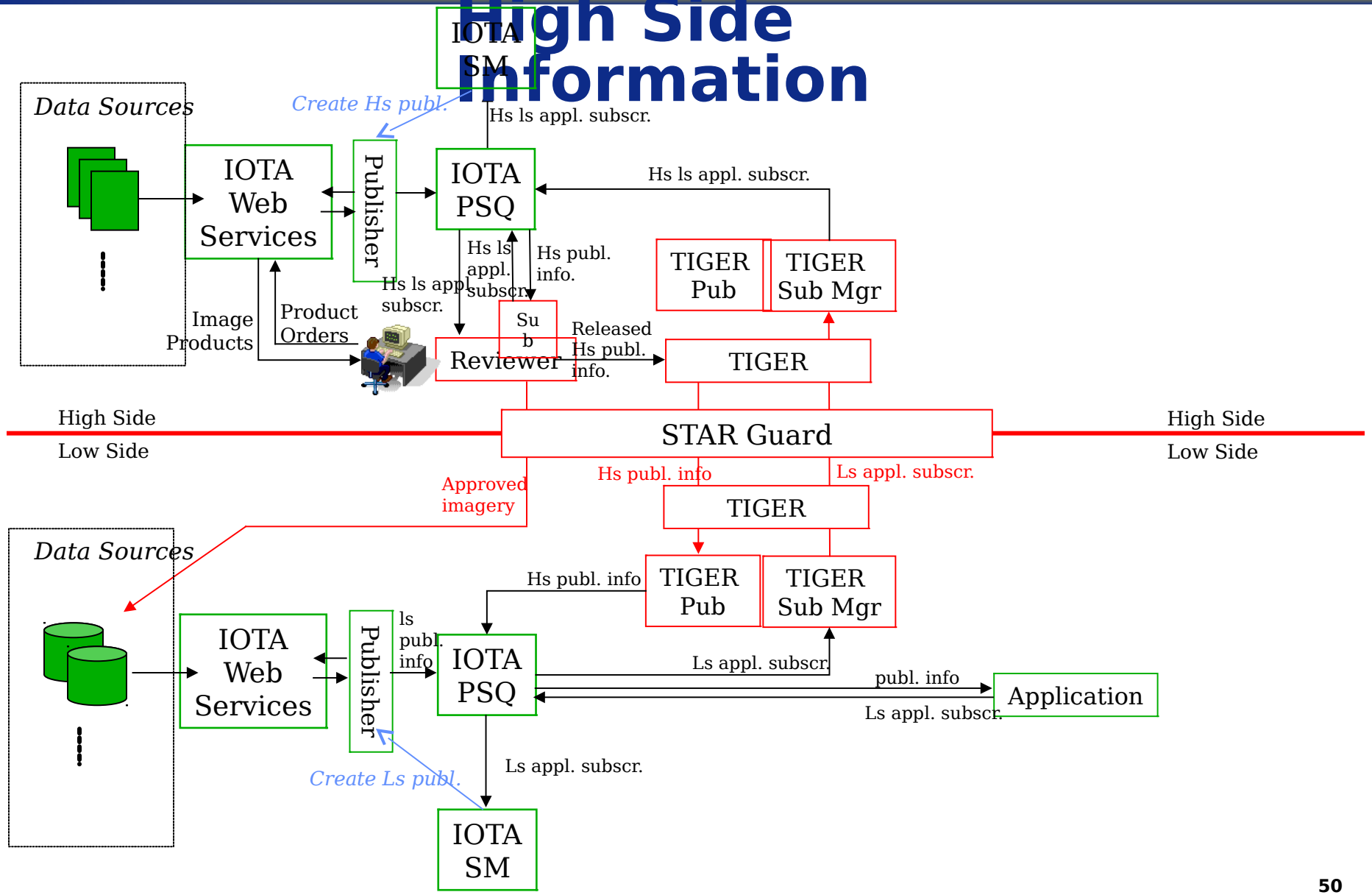
IOTA Software Dependencies

- **Application Server Choices**
  - JBoss Application Server, JBoss 3.2.3
    - *Tomcat servlet container 4.1.24*
  - WebLogic 8.1
- **Run Time Components**
  - Java(TM) 2 SDK, Standard Edition Version 1.4.2:
  - Apache Web Server 1.3.19
  - Apache eXtensible Interaction System, AXIS 1.1
    - *Java API for XML-based RPC JAX-RPC 1.0*
    - *SOAP 1.1 and 1.2*
    - *SOAP with Attachments API for Java, SAAJ 1.1*
    - *WSDL 1.1*
  - Xerces XML Parser 2.5.0
  - Castor binding framework, Castor 0.9.5.2
  - XQEngine XQuery/XPath parser 0.61
  - JavaCC 2.1
  - Joint Battlespace Infosphere, JBI 1.1
    - *MySql 4.0.18 for the Metadata and Information Object Repositories*
- **Build environment**
  - CVS v1.11
  - Ant 1.5.3

Low Side Subscriber to High Side Information

1. An application in the low side domain establishes a subscription. This involves opening a connection with the IOTA pub-sub-query (psq) component, publishing an IOTA subscription information object, and establishing the subscription. (These steps are performed within the IOTA psq API).
2. The IOTA Subscription Manager on the low side establishes a low-side publisher if needed. The application will receive any new information from low side data sources. (This is normal IOTA operation).
3. The Trusted ISSE Gateway for Exploration and Retrieval **(**TIGER) application includes a component like the IOTA Subscription Manager that subscribes to IOTA subscription information objects. The low side TIGER subscription manager receives the information object defining the low side application subscription.
4. The low side subscription info object is sent through STAR Guard to the high side TIGER subscription manager.
5. The high side TIGER subscription manager publishes the subscription information object to the high side IOTA. The IOTA psq metadata for the published information object indicates it is a low side subscription information object
6. A high side application has already been established to subscribe to low side subscriptions published by TIGER. Call it the High Side Low Side Subscription Reviewer (HSLSSR)
7. The HSLSSR queues the subscription for review. Once reviewed, if OK, the HSLSSR generates a new subscription for the same information and a client subscriber to receive it.
8. At some point in time, high side information objects matching the HSLSSR client subscription are published on the high side.
9. The HSLSSR application receives the published high side information objects and queues them for review.
10. If reviewed and approved, the high side information objects are sent through STAR Guard to the low side TIGER publisher application, which publishes them to the low side.
11. The low side IOTA PSQ matches the information published by low side TIGER with the original low side subscription and provides the information to the low side application via a callback (This is normal IOTA operation).
12. For imagery metadata, the reviewer will order the imagery products, review them, and push them with metadata through TIGER to the low side IPL ingest directory. In this case, the high side information objects do not need to be passed through to and published by the low side TIGER publisher, since they will be picked up by the low side publisher once ingested by IPL.

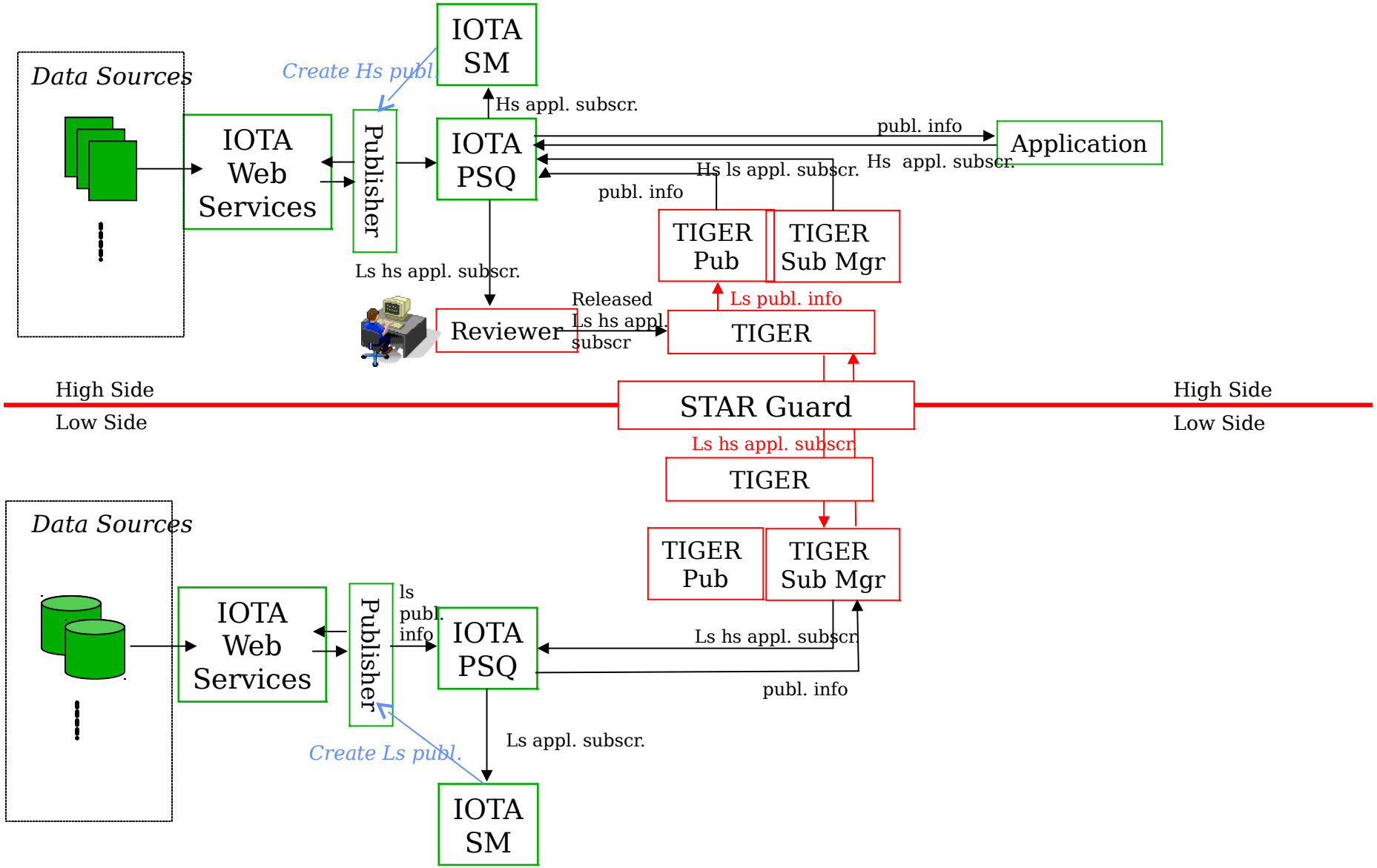
Low Side Subscriber to High Side Information



High Side Subscriber to Low Side Information

1. An application in the high side domain establishes a subscription.
2. The IOTA Subscription Manager on the high side establishes a high-side publisher if needed. The application will receive any new information from high side data sources.
3. The high side subscription is queued for human review by the Reviewer application. If approved it is released through TIGER and STAR Guard to the low side.
4. The Low side TIGER Subscription Manager generates a subscription request for the low side IOTA PSQ and establishes a subscribing client.
5. At some point in time, low side information matching the subscription is published on the low side.
6. The low side TIGER subscriber receives the information and pushes it through the Guard to the high side TIGER publisher
7. The high side TIGER publisher, publishes the information.
8. The high side application receives the published information.
9. Reach down for imagery products is tbd.

High Side Subscriber to Low Side Information

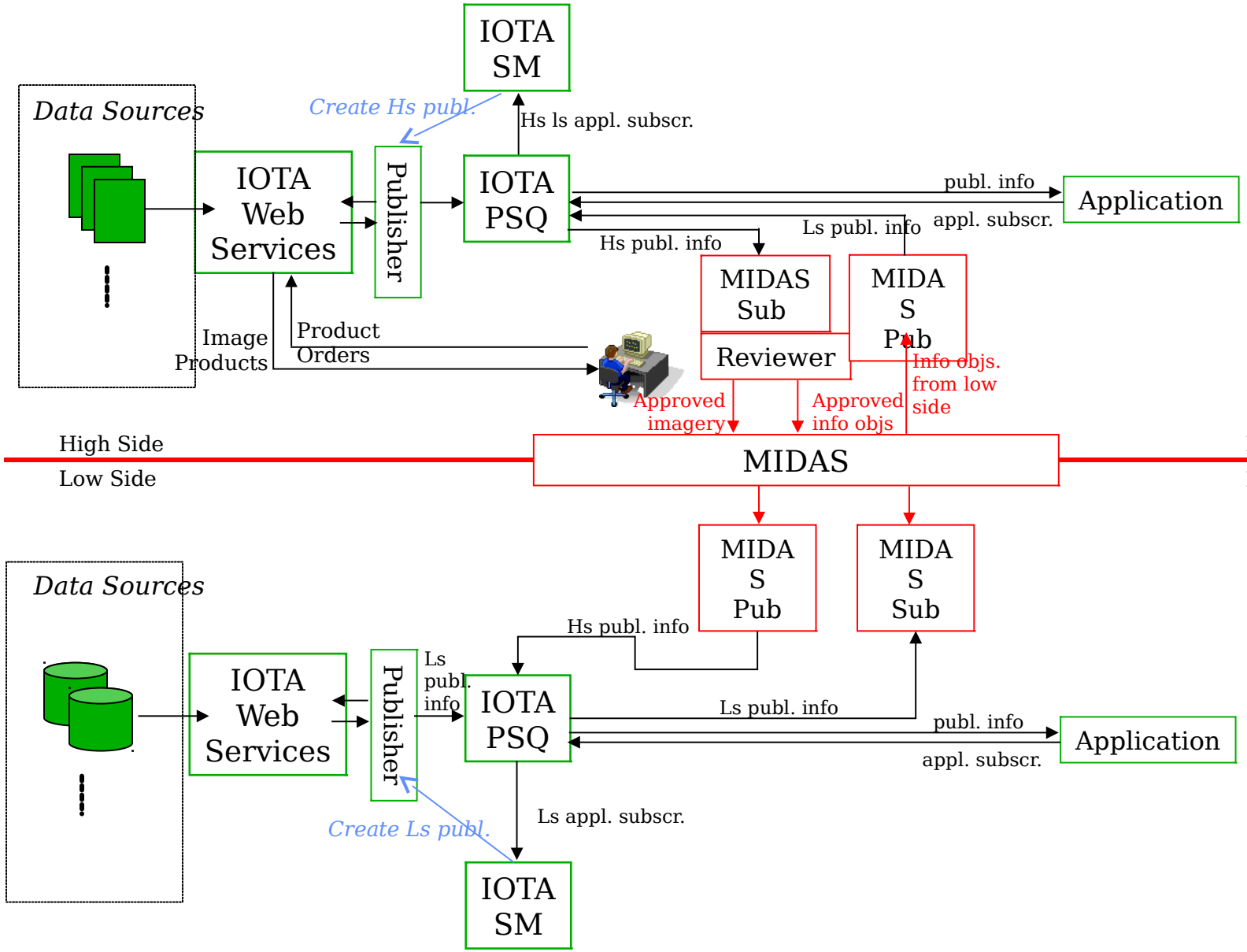


Pub-Sub with Multi Information Domain Access Server (MIDAS)

1. On the high side, a Reviewing application is established to subscribe to high side information objects being published.
2. Information objects received by the Reviewing application are reviewed and, if approved, are placed in the MIDAS repository tagged to provide for release to the low side. For information objects about imagery the reviewer orders the associated imagery product, reviews it and, if approved, and places it in the MIDAS repository
3. A low side MIDAS publisher monitors the MIDAS db for any new information objects from the high side and publishes them to the low side.
4. Low side subscribing applications receive the MIDAS info objects matching their subscriptions.

1. A low side MIDAS subscriber subscribes to Information objects published on the low side.
2. Received information objects are deposited into MIDAS.
3. A high side MIDAS publisher monitors the MIDAS db for new low side information objects and publishes them on the high side.
4. High side subscribing applications receive the MIDAS info objects matching their subscriptions.

Pub-Sub with MIDAS



WebTAS – IOTA Discussion

- **IOTA is used to populate the WebTAS data store**
  - **subscribers provide updates of new information from IOTA data sources**
  - **WebTAS integrates mechanisms to invoke IOTA services**
- **IOTA provides services to obtain WebTAS products for use by other applications.**
  - **define metadata standard for temporal analysis information products**

Why IOTA

- IOTA provides services for data source access that ANY application can use. This is useful in situations
  - Where more than one application requires the same data
  - Where a single point for discretionary access control is required
  - Where an application has to connect to different data sources in different environments where it is deployed to obtain the same data
- IOTA provides Integrated Products (Results Sets) – a single query hits multiple data sources
  - Data sources are configured at installation time (in IOTA 1.0)
  - Application uses well-defined service request parameters (e.g., BE number, geographic area, key words, date-time ranges)
- IOTA uses a standard representation for results and translates data source returns
- IOTA provides publish-subscribe for applications to automatically receive new data from data sources

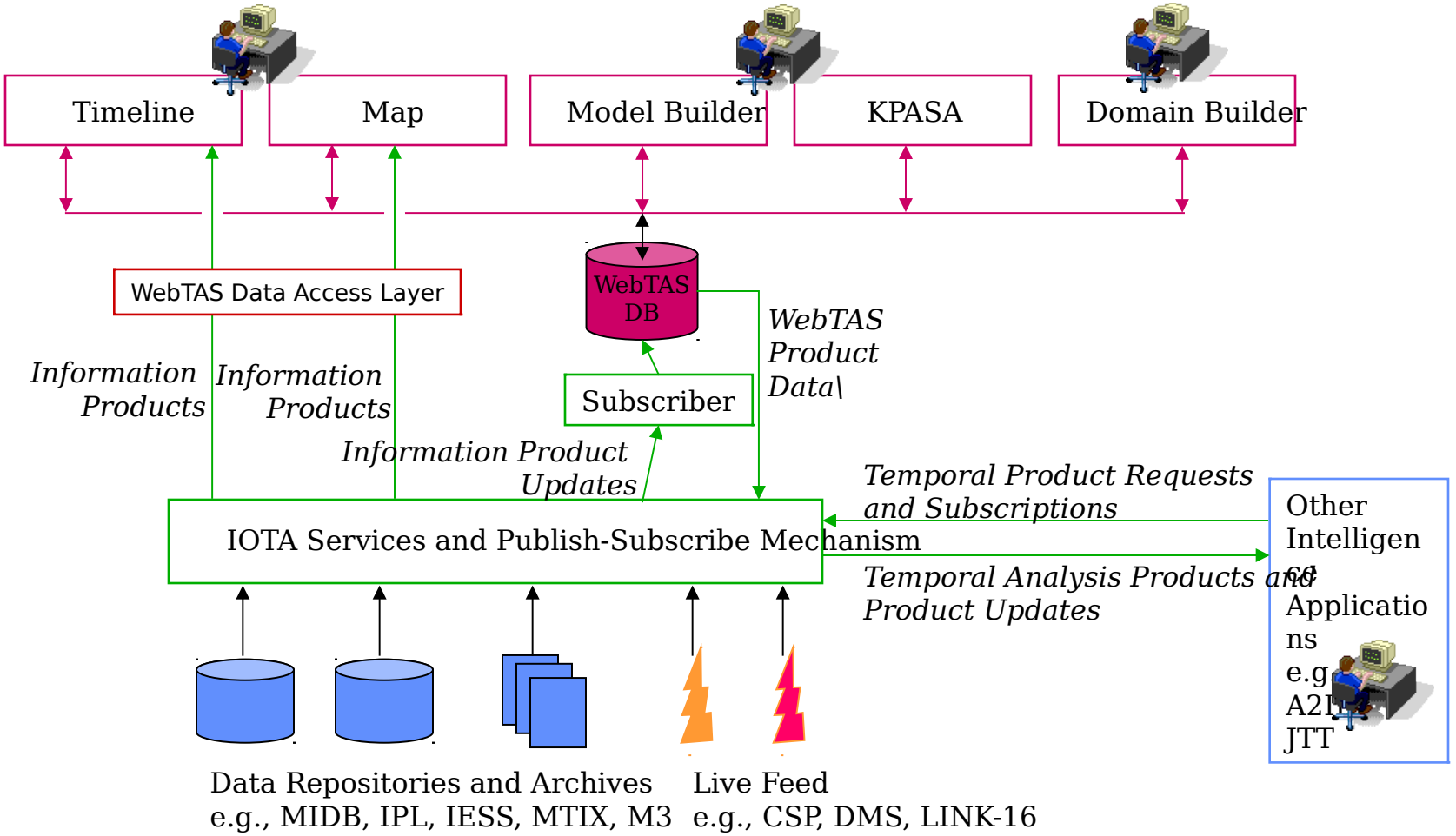
IOTA and ISSE WebTAS and DTW

- IOTA provides ***enterprise*** services
  - ISSE Guard provides ***enterprise*** cross-security domain services
- WebTAS data discovery is directed by ***users*** defining projects
  - DTW cross-boundary file transfer is initiated by ***users*** finding data to transfer

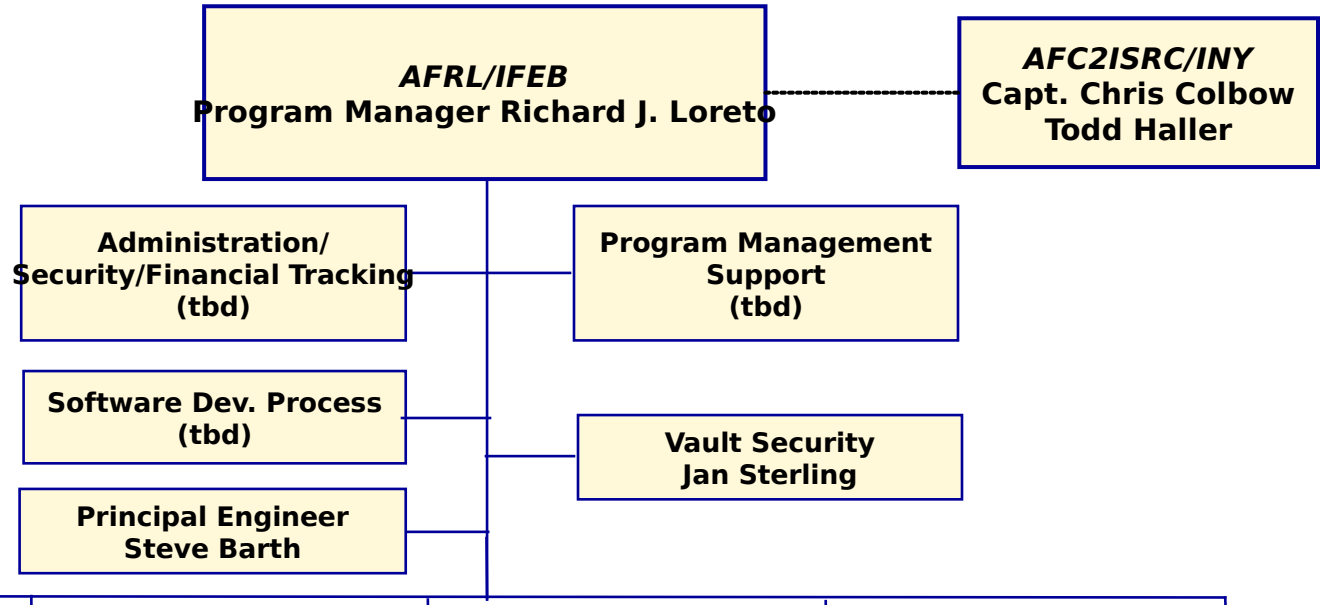
WebTAS – IOTA Interface Proposal

- **IOTA is used to populate the WebTAS data store**
  - **subscribers provide updates of new information from IOTA data sources**
  - **WebTAS integrates mechanisms to invoke IOTA services**
- **IOTA provides services to obtain WebTAS products for use by other applications.**
  - **define metadata standard for temporal analysis information products**

WebTAS with IOTA Information Flow Architecture



IOTA Program Office



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